

WHAT IS CLAIMED IS:

1. An in-pavement high intensity LED-based luminaire comprising:

a housing including a generally flat top surface having at least one transparent window for output light passage;

5 a power controller having an input and an output, wherein the input is electrically connected to an airfield power infrastructure and the output is electrically connected to a light module;

the light module including,

10 a plurality of high flux LEDs, wherein each of the LEDs is connected to the power controller and emits light with a wide divergence, said LEDs located linearly in a plane perpendicular to an LED optical axis;

a non-imaging light transformer that includes an input end opposite an output end, a refractive member located around the LED optical axis, and a total internal reflection member, wherein the light transformer collects a significant amount of light
15 through the input end that is emitted by the LEDs that are located at a distance equal to the light transformer's focal distance from the input end, compresses and redistributes the collected light in a vertical plane with high efficiency into a predetermined pattern, and directs the compressed light outside of the light module through the output end; and

a thermoelectric cooling device providing LED temperature control for
20 emitted luminous flux, color and spatial intensity distribution stabilization, wherein the thermoelectric device is electrically connected to the power controller.

2. A luminaire according to claim 1, wherein the window includes a sealing member forming a watertight seal between the window and the housing.

3. A luminaire according to claim 1, wherein the power controller is designed to

5 interface and operate with existing airport lighting infrastructure including intensity variation by constant current regulator compliance standard regulation.

4. A luminaire according to claim 1, further comprising a holder for supporting the LEDs and mounting the light transformer.

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5. A luminaire according to claim 4, wherein the holder is fabricated from material with low thermal resistance and is configured as a heat sink for the LEDs.

6. A luminaire according to claim 5, wherein the thermoelectric cooling device has

15 direct thermal contact on a cool side of the cooling device with the holder, and has direct thermal contact on a hot side of the cooling device with the housing that is configured as a radiator for the cooling device.

7. A luminaire according to claim 1, wherein the refractive member and the total

20 internal reflection member are integrated in a single transparent element having a mutual focal point.

8. A luminaire according to claim 1, wherein the light transformer is shaped as a rectangular bar in a horizontal cross-section and has a precalculated profile in a vertical cross-section.

5 9. An in-pavement high intensity LED-based luminaire comprising:

a housing including a generally flat top surface having at least one transparent window for output light passage;

a power controller having an input and an output, wherein the input is electrically connected to an airfield power infrastructure and the output is electrically

10 connected to a light module;

the light module including,

a plurality of high flux LEDs, wherein each of the LEDs is connected to the power controller and emits light with a wide divergence, said LEDs located linearly in a plane perpendicular to an LED optical axis;

15 a non-imaging light transformer that includes an input end opposite an output end, a refractive member located around the LED optical axis, and a total internal reflection member integrated in a single transparent element having a mutual focal point, wherein the light transformer is shaped as a rectangular bar in a horizontal cross-section and has a precalculated profile in a vertical cross-section, and wherein the light transformer
20 collects a significant amount of light through the input end that is emitted by the LEDs that are located at a distance equal to the light transformer's focal distance from the input end, compresses and redistributes the collected light in a vertical plane with high efficiency into a

predetermined pattern, and directs the compressed light outside of the light module through the output end;

a holder for supporting the LEDs and mounting the light transformer; and

a thermoelectric cooling device providing LED temperature control for

5 emitted luminous flux, color and spatial intensity distribution stabilization, wherein the thermoelectric device is electrically connected to the power controller, has direct thermal contact on a cool side of the cooling device with the holder, and has direct thermal contact on a hot side of the cooling device with the housing that is configured as a radiator for the cooling device.

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10. A luminaire according to claim 9, wherein the window includes a sealing member forming a watertight seal between the window and the housing.

11. A luminaire according to claim 9, wherein the power controller is designed to

15 interface and operate with existing airport lighting infrastructure including intensity variation by constant current regulator compliance standard regulation.

12. A luminaire according to claim 9, wherein the holder is fabricated from material with low thermal resistance and is configured as a heat sink for the LEDs.

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13. A luminaire according to claim 9, wherein the light module further includes a thermosensor, wherein the thermosensor is electrically connected to the power controller,

said power controller including an electronic circuit which allows automatically switching “on-off” power to the thermoelectrical cooling device to provide cooling only when an optical module temperature rises above a preselected threshold.

5 14. A light module, comprising:

a plurality of high flux LEDs located in linear alignment with high density in a plane perpendicular to a LED optical axis, wherein each LED is connected to a power controller and emits light with a wide divergence;

10 a non-imaging light transformer that includes an input end opposite an output end, a refractive member located around the LED optical axis, and a total internal reflection member integrated in a single transparent element having a mutual focal point, wherein the light transformer is shaped as a rectangular bar in a horizontal cross-section and has a precalculated profile in a vertical cross-section, and wherein the light transformer collects a significant amount of light through the input end that is emitted by the LEDs that are located
15 at a distance equal to the light transformer’s focal distance from the input end, compresses and redistributes the collected light in a vertical plane with high efficiency into a predetermined pattern, and directs the compressed light outside of the light module through the output end;

a holder for supporting the LEDs and mounting the light transformer, wherein
20 the holder is fabricated from material with a low thermal resistance and is configured as a heat sink for the LEDs; and

a thermoelectric cooling device providing LED temperature control for emitted luminous flux, color and spatial intensity distribution stabilization, wherein the thermoelectric device is electrically connected to the power controller, has direct thermal contact on a cool side of the cooling device with the holder, and has direct thermal contact on
5 a hot side of the cooling device with a radiator.

15. A light module according to claim 14, wherein the holder includes a LED support and a light transformer mounting, wherein the support and the mounting are joined together by a kinematic mechanism that allows mutual linear displacement of the support and the mounting
10 in the vertical plane.

16. A light module according to claim 14, further comprising a housing having an opening for passing light therethrough, said housing having direct thermal contact with the holder and configured as the outside radiator.

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17. A light module according to claim 16, wherein a light shaping element is dispersed along the opening.

18. A light module according to claim 17, wherein the light shaping element is a
20 holographic diffuser.